

State of Hawai'i
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Aquatic Resources
Honolulu, Hawai'i 96813

June 22, 2018

Board of Land and Natural Resources
Honolulu, Hawai'i

Request for Authorization and Approval to Issue a Papahānaumokuākea Marine National
Monument Research Permit to Dr. Carl Meyer, Hawai'i Institute of Marine Biology,
University of Hawai'i, for Access to State Waters to Conduct Research Activities to Quantify the
Movements and Ecology of Top Predators

The Division of Aquatic Resources (DAR) hereby submits a request for your authorization and approval for issuance of a Papahānaumokuākea Marine National Monument research permit to Applicant Dr. Carl Meyer, Hawai'i Institute of Marine Biology, University of Hawai'i, pursuant to § 187A-6, Hawai'i Revised Statutes (HRS), Chapter 13-60.5, Hawai'i Administrative Rules (HAR), and all other applicable laws and regulations.

The research permit, as described below, would allow entry and management activities to occur in Papahānaumokuākea Marine National Monument, including the NWHI State Marine Refuge and the waters (0-3 nautical miles) surrounding the following site:

- French Frigate Shoals
- Pearl and Hermes Atoll
- Midway Atoll

The activities covered under this permit would occur between June 25, 2018 thru June 24, 2019. The proposed activities are a continuation of work previously permitted and conducted in the Monument by Dr. Meyer and his team.

INTENDED ACTIVITIES

The applicant has submitted a renewal application to study the movement patterns of top predators (sharks and ulua). No land access is proposed. The applicant and up to six individuals would conduct maintenance, download and redeploy acoustic receivers at French Frigate Shoals, Pearl and Hermes Atoll, and Midway Atoll. Additional activities include lethally sampling up to 60 of the most common reef fishes from shallow and mesophotic reefs at FFS; equipping up to 60 additional ulua and Galapagos sharks (30 of each species at FFS) with pressure-sensor acoustic transmitters (detectable by the aforementioned acoustic receivers); equipping 5 ulua, 5 Galapagos sharks, and 5 tiger sharks with accelerometers and digital camera data loggers; and collecting muscle tissue samples from ulua and sharks. Sharks and ulua would be caught by trolling with artificial lures, mackerel (frozen), tuna, and fish caught under a separate Native Hawaiian Practices permit (pending issuance of permit no. PMNM-2018-030). Lastly, the

proposed activities would be supported by the MV Searcher (includes up to six crew members) which includes the following activities: anchoring on sandy substrate and discharging gray water and biodegradable waste from galley operations.

To safeguard Monument resources the applicant would abide by the following PMNM Best Management Practices (BMPs) while conducting the aforementioned activities within the PMNM: Best Management Practices for Boat Operations and Diving Activities (BMP #004); Marine Wildlife Viewing Guidelines (BMP #010); and Disease and Introduced Species Prevention Protocol for Permitted Activities in the Marine Environment (BMP #011).

The activity would provide empirical data on top predator's spawning habits, population sizes and movement patterns in the Monument. The applicant's proposed activities directly support the Monument Management Plan (MMP) Marine Conservation Science (MCS) Action Plan Strategy MCS-1: Continue and enhance research, characterization and monitoring of marine ecosystems (PMNM MMP Vol. I, p. 122, 2008).

The activities described above may require the following regulated activities to occur in State waters:

- ☒ Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving Monument resource
- ☒ Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on submerged lands
- ☒ Discharging or depositing any material or matter into the Monument
- ☒ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
- ☒ Attracting any living Monument resources
- ☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

REVIEW PROCESS

The permit application was sent out for review and comment to the following scientific and cultural entities: Hawai'i Division of Aquatic Resources, Hawai'i Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). In addition, the permit application has been posted on the Monument Web site since February 16, 2018, giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy.

Comments received from the scientific community are summarized as follows:

QUESTIONS:

- 1. Page 4: "We are requesting to lethally sample no more than 60 individuals from the most common species of reef fishes." Can the PI provide a list of what they consider**

“common” species that will be targeted? There wasn’t one in the application materials. Assuming they will try to target the same or similar species to previous collections in these areas. No real concern with the number of individuals being taken.

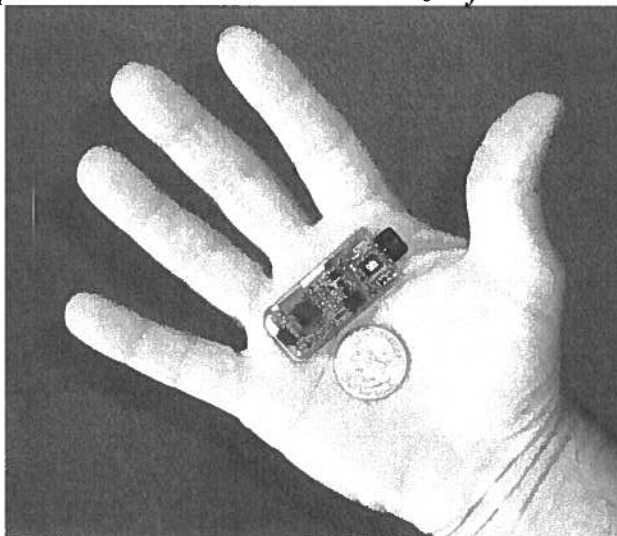
*Species will include those commonly found on French Frigate Shoals mesophotic reefs including milletseed butterfly fish (*Chaetodon milliaris*), soldierfish (*Myripristis* sp.), Orange band surgeonfish (*Acanthurus olivaceus*), manybar goatfish (*Parapeneus multifasciatus*), threespot chromis (*Chromis verater*).*

- 2. Where will the vessel be anchoring? Will they make sure they are not impacting the corals and other benthic organisms when they anchor?**

The vessel will be anchored on sandy substrates in previously used anchorages in the vicinity of La Perouse pinnacle.

- 3. Have Ulua been tagged with the digital cameras before? How big are the cameras and what size fish are they planning to attach them to? There should be a minimum size for the Ulua that have the cameras on them (what is the min size?). Large tags and cameras can cause drag for fish that are on the smaller size, and can injure the fish over time.**

*This will be the first use of cameras on ulua (to best of our knowledge) but this technology has been used previously on other medium to large teleosts including sea bass, ocean sunfish and Japanese red-eye (*Lates japonicas*). Deployment times are short (several days) and the cross sectional area of the package (which determines drag) is kept as small as possible. The cameras are the size of a thumb drive:*



- 4. The cable ties come off as well as the instruments?**

Yes, the release mechanism breaks the cable tie allowing it to be shed by the fish/shark.

5. **How are you collecting fishes at 150-300 feet? Without a chamber, the Searcher seems ill-equipped to support technical diving.**

In addition to Searcher, we are planning to conduct research from the NOAA vessel Hiialakai

6. **I believe the Searcher is only going to FFS. How are you collecting fishes at Pearl and Hermes, and Midway?**

In addition to Searcher, we are planning to conduct research from the NOAA vessel Hiialakai

7. **What kind of bait will be used?**

Tuna, mackerel (frozen) and artificial lures.

COMMENTS / RECOMMENDATIONS:

1. **This group is very knowledgeable and has been doing this for many years with great success.**
2. **Papastamatiou et al. 2015 is cited, but is not in the References section.**

Papastamatiou YP, Meyer CG, Kosaki RK, Natalie J. Wallsgrove NJ, Popp BN. 2015. Movements and foraging of predators associated with mesophotic reefs and their potential for linking ecological habitats. Marine Ecology Progress Series: 521:155-170. doi:10.3354/meps11110

3. **NMFS Comment – This has been an ongoing project, and those involved have a wealth of experience. NMFS has no comments.**
4. **DAR has no concerns regarding a) tagging via transmitter implantation and external dart tags of 60 additional ulua and Galapagos sharks (30 of each species at FFS) with pressure-sensor acoustic transmitters, b) equipping 5 ulua, 5 Galapagos sharks and 5 tiger sharks at FFS/PHR/MID with triaxial accelerometers and digital camera data loggers to provide high resolution information on swimming patterns, habitat use and feeding, c) collecting small samples of muscle tissue from predators (ulua, Galapagos sharks) for chemical analyses (stable isotopes), from FFS and PHR and the lethal sample up to 60 of the commonest reef fishes from shallow and mesophotic reefs at FFS. *No cumulative impacts are anticipated if the permittee adheres to the following conditions:***

Permittee should mitigate for the spread of invasive species between areas of collection. Collection equipment (including but not limited to fishing hooks, biopsy tools, tagging tools, three-prongs, etc.) should be inspected and disinfected between sampling different areas to mitigate for the spread of aquatic invasive species, coral

disease or other pathogens or parasitic organisms. Efforts should be made by permittee and authorized assistants to ensure that collection of samples is conducted in such a manner as the process does not result in any additional harm to surrounding marine organisms. Efforts will be made by permittee and authorized assistants to distribute collection activities across shoreline/reef flat/benthic areas, so as not to consolidate the impacts of collection in one location. In addition, as stated by researcher, *any non-target species should be immediately released.*

5. DAR has no concerns regarding the redeployment of existing 21 receivers currently deployed at 3 islands/atolls in the Monument to provide continued monitoring coverage within the Monument. *No cumulative impacts are anticipated if the permittee adheres to the following conditions:*

Entanglement prevention: Efforts will be made by permittee and authorized assistants to utilize best management practices to eliminate any potential for incidental entanglement of any marine organism. Entanglement prevention practices will include but are not limited to: minimizing the amount of structures or components that may potentially cause entanglement during research operations (loops, holes, slack lines, etc.). Permittee will immediately notify DAR and the appropriate federal agency to report the entanglement of any protected species if incidental entanglement occurs. All research materials will be removed from environment after research is conducted, except for what has been stated: For mesophotic acoustic arrays, the **end weights (cinder block) and lower 30cm of the mooring (chain, polypro and twine)** will be left in situ when the receivers are recovered. All research materials will be removed from shallow placement of acoustic arrays.

DAR requests to review and provide comments if anything exceeding what has been stated (**end weights (cinder block) and lower 30cm of the mooring (chain, polypro and twine)**) will be left behind. DAR requests that research minimize entanglement potential by eliminating any loops that may occur in the attachment of the **lower 30cm of the mooring (chain, polypro and twine)** to the cinder block, as this structure will be left on the ocean floor and may pose as future entanglement risks. If possible, DAR requests the **lower 30cm to consist of sinking line or chain to eliminate the suspension of line in the water column.**

We accept the DAR conditions and will implement their suggestions.

Comments received from the Native Hawaiian community are summarized as follows:

Cultural reviews support the acceptance of this application. No concerns were raised.

Comments received from the public are summarized as follows:

No comments were received from the public on this application.

Additional reviews and permit history:

Are there other relevant/necessary permits or environmental reviews that have or will be issued with regard to this project? (e.g., MMPA, ESA, EA) Yes ☒ No ☐

If so, please list or explain:

- The proposed activities are in compliance with the National Environmental Policy Act.
- The proposed activities are in compliance with the National Historic Preservation Act.
- An informal consultation pursuant to section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. §1531 et seq.) was conducted. The outcome of this review may require the applicant to adhere to other NMFS-prescribed conditions. Such conditions would be reflected in the PMNM permit, prior to issuance.
- An informal review of all aforementioned activities following section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA; 16 U.S.C. 1855(b)) is currently underway. The outcome of this review may require the applicant to adhere to other NMFS-prescribed conditions. Such conditions would be reflected in the PMNM permit, prior to issuance.
- The Department has made an exemption determination for this permit in accordance chapter 343, HRS, and Chapter 11-200, HAR. See Attachment ("DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR PAPA HĀNAUMOKUĀKEA MARINE NATIONAL MONUMENT RESEARCH PERMIT TO DR. CARL MEYER, HAWAII INSTITUTE OF MARINE BIOLOGY, UNIVERSITY OF HAWAII, FOR ACCESS TO STATE WATERS TO CONDUCT TOP PREDATOR FEEDING HABITS AND MOVEMENT RESEARCH ACTIVITIES UNDER PERMIT PMNM-2018-015."

Has Applicant been granted a permit from the State in the past? Yes ☒ No ☐

If so, please summarize past permits:

- The Applicant was granted permits between 2008 through 2012 for similar work (PMNM-2008-027, PMNM-2009-009, PMNM-2009-036, PMNM-2009-037, PMNM-2010-019, PMNM-2011-018, PMNM-2012-050, PMNM-2014-014, PMNM-2017-015.)

Have there been any a) violations: Yes ☐ No ☒
 b) Late/incomplete post-activity reports: Yes ☐ No ☒

Are there any other relevant concerns from previous permits? Yes ☐ No ☒

STAFF OPINION

PMNM staff is of the opinion that the Applicant has properly demonstrated valid justification for their application and should be allowed to enter the NWHI State waters and conduct the activities therein as specified in the application with certain special instructions and conditions, which are in addition to the Papahānaumokuākea Marine National Monument Research Permit General Conditions. All suggested special conditions have been vetted through the legal counsel of the Co-Trustee agencies (see Recommendation section).

MONUMENT MANAGEMENT BOARD OPINION

The MMB is of the opinion that the Applicant has met the findings of Presidential Proclamation 8031 and this activity may be conducted subject to completion of all compliance requirements. The MMB concurs with the special conditions recommended by PMNM staff.

RECOMMENDATION:

That the Board declare that the actions which are anticipated to be undertaken under this permit will have little or no significant effect on the environment and is therefore exempt from the preparation of an environmental assessment.

That the Board authorize and approve a Research Permit to Dr. Carl Meyer, Hawai'i Institute of Marine Biology, University of Hawai'i, with the following special conditions:

1. This permit is not to be used for nor does it authorize the sale of collected organisms. Under this permit, the authorized activities must be for noncommercial purposes not involving the use or sale of any organism, by-products, or materials collected within the Monument for obtaining patent or intellectual property rights.
2. The permittee may not convey, transfer, or distribute, in any fashion (including, but not limited to, selling, trading, giving, or loaning) any coral, live rock, or organism collected under this permit without the express written permission of the Co-Trustees.
3. To prevent introduction of disease or the unintended transport of live organisms, the permittee must comply with the disease and transport protocols attached to this permit.
4. Tenders and small vessels must be equipped with engines that meet EPA emissions requirements.
5. Refueling of tenders and all small vessels must be done at the support ships and outside the confines of lagoons or near-shore waters in the State NWHI Marine Refuge.

Respectfully submitted,



Maria Carnevale
State Co-Manager
Papahānaumokuākea Marine National Monument



APPROVED FOR SUBMITTAL



SUZANNE CASE
Chairperson

Papahānaumokuākea Marine National Monument
RESEARCH Permit Application

NOTE: This Permit Application (and associated Instructions) are to propose activities to be conducted in the Papahānaumokuākea Marine National Monument. The Co-Trustees are required to determine that issuing the requested permit is compatible with the findings of Presidential Proclamation 8031. Within this Application, provide all information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Papahānaumokuākea Marine National Monument (Monument).

ADDITIONAL IMPORTANT INFORMATION:

- Any or all of the information within this application may be posted to the Monument website informing the public on projects proposed to occur in the Monument.
- In addition to the permit application, the Applicant must either download the Monument Compliance Information Sheet from the Monument website OR request a hard copy from the Monument Permit Coordinator (contact information below). The Monument Compliance Information Sheet must be submitted to the Monument Permit Coordinator after initial application consultation.
- Issuance of a Monument permit is dependent upon the completion and review of the application and Compliance Information Sheet.

INCOMPLETE APPLICATIONS WILL NOT BE CONSIDERED

Send Permit Applications to:
NOAA/Inouye Regional Center
NOS/ONMS/PMNM/Attn: Permit Coordinator
1845 Wasp Blvd, Building 176
Honolulu, HI 96818
nwhipermi@noaa.gov
PHONE: (808) 725-5800 FAX: (808) 455-3093

**SUBMITTAL VIA ELECTRONIC MAIL IS PREFERRED BUT NOT REQUIRED. FOR
ADDITIONAL SUBMITTAL INSTRUCTIONS, SEE THE LAST PAGE.**

Papahānaumokuākea Marine National Monument Permit Application Cover Sheet

This Permit Application Cover Sheet is intended to provide summary information and status to the public on permit applications for activities proposed to be conducted in the Papahānaumokuākea Marine National Monument. While a permit application has been received, it has not been fully reviewed nor approved by the Monument Management Board to date. The Monument permit process also ensures that all environmental reviews are conducted prior to the issuance of a Monument permit.

Summary Information

Applicant Name: Carl G. Meyer

Affiliation: Hawaii Institute of Marine Biology

Permit Category: Research

Proposed Activity Dates: May thru September 2018

Proposed Method of Entry (Vessel/Plane): Vessel

Proposed Locations: French Frigate Shoals, Pearl & Hermes Reef, Midway

Estimated number of individuals (including Applicant) to be covered under this permit: 7

Estimated number of days in the Monument: 50

Description of proposed activities: (complete these sentences):

a.) The proposed activity would...

Quantify the movements and trophic ecology of top predators (sharks and large fishes) in the Monument to: (1) improve our broad understanding of Monument ecology, (2) further elucidate the role of deep reefs in Monument ecology, and (3) enhance our understanding of food web dynamics in the Monument.

b.) To accomplish this activity we would

At FFS, PHR and Midway, recover, download and redeploy acoustic receivers at long-term monitoring sites. At FFS atoll, capture and equip top predators with electronic tags and small video cameras, and monitor their movements using acoustic receivers (deployed on the sea floor). Collect small, non-lethal tissue samples from top predators for chemical analysis to determine feeding habits. Collect reference isotopic samples from deep and shallow reefs by lethal sampling of up to 60 reef fishes (collected via 3-prong pole spear). These reference samples will be used to determine the trophic position and feeding location of predators, and clarify the food web baseline in Monument locations.

c.) This activity would help the Monument by ...

Our research will provide Monument managers with information on the long-term movement patterns and feeding habitats of culturally and ecologically important top predators, and clarify predator-mediated nutrient transport between shallow and mesophotic habitats. Increasing understanding of the mesophotic zone and studying trophic dynamics, and the flow of energy and nutrients between shallow and mesophotic coral reef habitats, were identified as priority research themes in a recent National Fish and Wildlife Foundation request for proposals to which we have applied. We will address the following specific questions at FFS atoll:

Are wide-ranging carnivores a trophic link between shallow and mesophotic coral ecosystems? Should shallow and mesophotic coral ecosystems be managed as tropically distinct ecosystems, or together as a single unified coral reef ecosystem?

Other information or background:

We have successfully implemented previous similar studies in Papahānaumokuākea and already have ongoing predator tracking research at FFS, positioning us to take full advantage of our existing telemetry infrastructure and local knowledge of this atoll. Our previous study conducted at Pearl and Hermes Reef (PHR) in Papahānaumokuākea (Papastamatiou et al. 2015), showed that Galapagos sharks and giant trevally associated with mesophotic reefs also utilize shallow reef habitats. The bulk tissue and amino acid compound specific isotopic compositions of these predators suggest they primarily forage in shallow reefs, although approximately 35% of resources came from mesophotic reefs. Overall, results from PHR suggest mesophotic reefs are both foraging grounds and refuge habitats for mobile predators, and frequent movements between habitats suggest mobile predators may function as significant transporters of nutrients, particularly from shallow to mesophotic reefs. Our previous study provided important insights into trophic linkages between shallow and mesophotic habitats at PHR, but we don't know whether similar dynamics exist at FFS. Obtaining a better understanding of shallow-mesophotic trophic dynamics and energy flow at FFS, is vital for understanding ecosystem function at FFS, and also for elucidating whether shallow-mesophotic trophic dynamics are broadly similar across the predator-rich atolls within Papahānaumokuākea. Furthermore, we can use more recently developed analytical methods to estimate the amount of nitrogen being deposited in specific habitats. We are well-placed to answer these questions because we have an ongoing study of predator ecology at FFS with telemetry infrastructure already in place, and demonstrated ability to capture, biopsy (for isotope analyses) and tag coral reef predators in both shallow and mesophotic habitats at this atoll. Our research has minimal impact on monument resources. Sharks and other predators are captured, tagged and released at their capture locations. Our listening stations (acoustic receiver + moorings) are designed to have minimal substrate impact and leave nothing behind when they are removed. We

are requesting to lethally sample no more than 60 individuals from the most common species of reef fishes.

Section A - Applicant Information

1. Applicant

Name (last, first, middle initial): Carl G. Meyer

Title: Assistant Researcher

1a. Intended field Principal Investigator (See instructions for more information):
Carl Meyer

2. Mailing address (street/P.O. box, city, state, country, zip):

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

For students, major professor's name, telephone and email address:

3. Affiliation (institution/agency/organization directly related to the proposed project):
University of Hawaii/Hawaii Institute of Marine Biology

4. Additional persons to be covered by permit. List all personnel roles and names (if known at time of application) here (e.g. John Doe, Research Diver; Jane Doe, Field Technician):

Yannis Papastamatiou, co-PI, Research Diver

TBD, Research Diver, Field Technician

TBD, Research Diver, Field Technician

TBD, Research Diver, Field Technician

TBD, Research Diver, Field Technician

TBD, Research Diver, Field Technician

Section B: Project Information

5a. Project location(s):

<input type="checkbox"/> Nihoa Island	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Necker Island (Mokumanamana)	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
X French Frigate Shoals	<input type="checkbox"/> Land-based	X Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Gardner Pinnacles	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Maro Reef			
<input type="checkbox"/> Laysan Island	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Lisianski Island, Neva Shoal	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
X Pearl and Hermes Atoll	<input type="checkbox"/> Land-based	X Shallow water	<input type="checkbox"/> Deep water
X Midway Atoll	<input type="checkbox"/> Land-based	X Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Kure Atoll	<input type="checkbox"/> Land-based	<input type="checkbox"/> Shallow water	<input type="checkbox"/> Deep water
<input type="checkbox"/> Other			

Ocean Based

NOTE: Shallow water is defined by water less than 100 meters in depth.

☐ Remaining ashore on any island or atoll (with the exception of Sand Island, at Midway Atoll and field camp staff on other islands/atolls) between sunset and sunrise.

NOTE: There is a fee schedule for people visiting Midway Atoll National Wildlife Refuge via vessel and aircraft.

Location Description:

Fishing/Tagging

Fish capture and tagging will be carried out from small vessels (launched from a mother ship) and will occur in the shallow waters around the Monument locations listed above.

Receiver Deployment and Recovery

A total of 21 receivers are currently deployed at 3 islands/atolls in the Monument (Appendix 1). Our goal is to service and redeploy these existing receivers to provide continued monitoring coverage within the Monument.

Reef fish collection

Up to 60 reef fishes will be collected using pole spears in shallow waters and on mesophotic reefs (depth 150-300ft) at FFS.

5b. Check all applicable regulated activities proposed to be conducted in the Monument:

- X Removing, moving, taking, harvesting, possessing, injuring, disturbing, or damaging any living or nonliving Monument resource
- X Drilling into, dredging, or otherwise altering the submerged lands other than by anchoring a vessel; or constructing, placing, or abandoning any structure, material, or other matter on the submerged lands

- ☐ Anchoring a vessel
- ☐ Deserting a vessel aground, at anchor, or adrift
- ☒ Discharging or depositing any material or matter into the Monument
- ☐ Touching coral, living or dead
- ☒ Possessing fishing gear except when stowed and not available for immediate use during passage without interruption through the Monument
- ☒ Attracting any living Monument resource
- ☐ Sustenance fishing (Federal waters only, outside of Special Preservation Areas, Ecological Reserves and Special Management Areas)
- ☐ Subsistence fishing (State waters only)
- ☒ Swimming, snorkeling, or closed or open circuit SCUBA diving within any Special Preservation Area or Midway Atoll Special Management Area

6. Purpose/Need/Scope *State purpose of proposed activities:*

(a) Purpose of proposed activities

The purpose of this research is to provide managers with empirical data on top predator movement patterns and feeding habitats in Monument waters, and to increase understanding of the mesophotic zone by quantifying the flow of energy and nutrients between shallow and mesophotic coral reef habitats. This information will provide managers with a clearer understanding of the role top predators play in food web dynamics in Monument waters.

We aim to answer the following specific management questions related to mesophotic habitats: Are wide-ranging carnivores a trophic link between shallow and mesophotic coral ecosystems? Should shallow and mesophotic coral ecosystems be managed as tropically distinct ecosystems, or together as a single unified coral reef ecosystem?

We have the following specific objectives;

1. Download 21 underwater receivers currently stationed in the Monument to retrieve stored movement data from predators previously-tagged in both Monument and Main Hawaiian Island waters.
2. Determine how widely these animals have ranged since Fall 2017 and identify their patterns of movement.
3. Equip up to 60 additional ulua and Galapagos sharks (30 of each species at FFS) with pressure-sensor acoustic transmitters detectable by our listening array. These tag deployments will enable us to further clarify 'upslope-downslope' movements between shallow and mesophotic habitats by abundant monument predators.
4. Equip up to 5 ulua, 5 Galapagos sharks and 5 tiger sharks at FFS/PHR/MID with tri-axial accelerometers and digital camera data loggers to provide high resolution information on swimming patterns, habitat use and feeding.
5. Collect small samples of muscle tissue from predators (ulua, Galapagos sharks) for chemical analyses (stable isotopes), from FFS and PHR to provide insight into predator feeding habits and reproductive status (up to 60 predators in total will be sampled). A small, non-lethal biopsy will be taken from each predator during tagging activities. To establish the chemical composition of prey species, tissue samples will be collected from 60 reef fishes collected at shallow and deep locations at FFS (see lethal collections below).
6. Lethally sample up to 60 of the commonest reef fishes from shallow and mesophotic reefs at FFS.

(b) Need for proposed activities

Top predators play an important role in many ecosystems and in Monument waters this role is filled by sharks (primarily tiger, galapagos, gray reef and whitetip reef sharks) and large teleost fishes (primarily ulua) (Wetherbee et al. 1997, Friedlander & DeMartini 2002, Holzwarth et al. 2006, Papastamatiou et al., 2006). Science-based management of the marine top predators of the Hawaiian archipelago requires that we know whether key species are site-attached to specific areas or, if not, how frequent and extensive are their movements. Since 2005 we have been using a combination of acoustic and satellite tags to quantify top predator movements in the Monument, and address three broad questions relevant to management zoning; (1) Do top predators move across open ocean between atolls?, (2) How extensive are their intra-atoll movements?, and (3) Do top predators exhibit predictable patterns of movement and habitat use?

Using these technologies we have already made substantial progress in quantifying predator movement patterns in Monument waters and beyond (see Meyer et al. 2007a,b, Meyer et al. 2009, 2010, Papastamatiou et al. 2013, Papastamatiou et al. 2015). For example, we have shown that tiger sharks routinely swim between atolls, range along the entire Hawaiian archipelago and venture hundreds of miles beyond Monument boundaries into open-ocean. Mature female tiger sharks may travel from monument waters to the Main Hawaiian Islands for pupping during the fall (Papastamatiou et al. 2013). We also obtained the first empirical evidence that gray reef sharks swim across open-ocean between atolls. We have found other top predators (e.g. ulua, Galapagos sharks) are site-attached to individual atolls, but wide-ranging within their 'home' atoll (e.g., Meyer et al., 2007a,b, 2010). We discovered that ulua & uku have predictable patterns of movement, including diel habitat shifts and tidal & lunar rhythmicity (Meyer et al., 2007a,b). We also found that during summer full moons, ulua from all over French Frigate Shoals atoll converge on one particular location where they form large spawning aggregations (Meyer et al., 2007a).

Although we have already made substantial progress in quantifying predator movement patterns in Monument waters, important questions remain unanswered. We have gained considerable insight into the horizontal movements of Monument predators but are still in the process of elucidating their vertical movements. For example, our most recent research has revealed that both ulua and Galapagos sharks range between shallow and mesophotic habitats, but patterns of vertical behavior are highly variable between individuals of the same species. This variability in vertical movements is also reflected in the isotopic composition of predator tissues (Papastamatiou et al. 2015), suggesting possible individual specialization in diet and different foraging strategies and habitats within the same species at a single Monument location. These questions have important implications for understanding ecosystem function and resolving important management questions such as whether ulua are competing for food with critically endangered monk seals. Recent surveys of mesophotic reefs in the Monument suggest that these areas maybe important habitat for several life stages of reef fishes and invertebrates, highlighting the importance of understanding the links between

mesophotic and shallow reefs. Our results from PHR suggest that predators utilize mesophotic reefs and may in fact be important vectors, transferring nutrients from shallow to deeper reefs (Papastamatiou et al. 2015). To expand on this work we need to see whether similar patterns exist at other islands and atolls of the NWHI.

(c) Scope of proposed activities

We propose to recover, download and redeploy up to 21 receivers already stationed in Monument waters (see Appendix 1). This will enable us to recover another 12 months (i.e. 2017-2018) of predator movement data and to continue monitoring our transmitter-equipped predators in order to determine how their movement patterns vary over multi-year time-scales. In order to quantify the vertical (depth) movements of ulua and Galapagos sharks, we propose implanting pressure-sensor acoustic transmitters (to quantify swimming depth) into 30 individuals from each species (i.e. 60 predators total) at FFS. To provide additional, high-resolution data on movement patterns, habitat use and feeding, we are also proposing to equip 5 ulua, 5 Galapagos sharks and 5 tiger sharks with accelerometer-digital camera data loggers at FFS and/or PHR and/or MID.

To quantify trophic ecology of predators at FFS, we will obtain muscle biopsies from all Galapagos sharks and uluas captured (up to 60 total). We will analyze the isotopic content of muscle tissue to determine carbon:nitrogen ratios, which will provide insight into the trophic levels of these animals and where they are foraging. To ground truth carbon values for FFS, we will also collect a total of up to 60 reef fishes from among the most common species from mesophotic and shallow water (30-60ft) sites. We will select shallow water collection sites that are directly inshore from the mesophotic collection sites. Experienced collectors will use three-prong spears to capture reef fishes at both shallow and mesophotic sites. Note that to minimize temporal variation in isotope signatures, tissue samples from predators/reef fish need to be collected at the same time (i.e. we cannot use tissues from frozen specimens collected in previous years).

References

Friedlander AM and EE DeMartini (2002). Contrasts in density, size, and biomass of reef fishes between the northwestern and the main Hawaiian islands: the effects of fishing down apex predators. *Marine Ecology Progress Series* 230:253-264.

Holzwarth SR, DeMartini EE, Zgliczynski BJ, Laughlin JL (2006) Sharks and jacks in the Northwestern Hawaiian Islands from towed-diver surveys 2000-2003. *Atoll Research Bulletin* 543: 257-280.

Meyer CG and R Honebrink (2005) Retention of surgically implanted transmitters by bluefin trevally (*Caranx melampygus*). Implications for long-term movement studies. *Transactions of the American Fisheries Society*. 134:602-606.

Meyer CG, Holland KN, Papastamatiou YP. 2007a. Seasonal and diel movements of giant trevally (*Caranx ignobilis*) at remote Hawaiian atolls: implications for the design of Marine Protected Areas. Marine Ecology Progress Series. 333: 13-25.

Meyer CG, Papastamatiou YP, Holland KN. 2007b. Seasonal, diel and tidal movements of green jobfish (*Aprion virescens*, Lutjanidae) at remote Hawaiian atolls: Implications for Marine Protected Area design. Marine Biology. 151: 2133-2143.

Meyer CG, Clark TB, Papastamatiou YP, Whitney NM, Holland KN. 2009. Long-term movements of tiger sharks (*Galeocerdo cuvier*) in Hawaii. Marine Ecology Progress Series. 381: 223–235.

Meyer CG, Papastamatiou YP, Holland KN. 2010. A multiple instrument approach to quantifying the movement patterns and habitat use of Tiger (*Galeocerdo cuvier*) and Galapagos sharks (*Carcharhinus galapagensis*) at French Frigate Shoals, Hawaii. Marine Biology. 157:1857–1868. DOI: 10.1007/s00227-010-1457-x

Meyer CG, Meyer CG, O'Malley JM, Papastamatiou YP, Dale JJ, Hutchinson MR, et al. 2014. Growth and Maximum Size of Tiger Sharks (*Galeocerdo cuvier*) in Hawaii. PLoS ONE 9(1): e84799. doi:10.1371/journal.pone.0084799.

Papastamatiou YP, Wetherbee BM, Lowe CG, Crow GC. 2006. Distribution and diet of four species of carcharhinid shark in the Hawaiian Islands: evidence for resource partitioning and competitive exclusion. Marine Ecology Progress Series 320: 239-251

Papastamatiou YP, Meyer CG, Carvalho F, Dale JJ, Hutchinson MR, et al. 2013. Telemetry and random walk models reveal complex patterns of partial migration in a large marine predator. Ecology 94: 2595-2606. doi: 10.1890/12-2014.1.

Wetherbee BM, Crow GL and CG Lowe (1997). Distribution, reproduction and diet of the gray reef shark *Carcharhinus amblyrhynchos* in Hawaii. Marine Ecology Progress Series 151: 181-189.

*Considering the purpose of the proposed activities, do you intend to film / photograph federally protected species? Yes ☐ No ☒

If so, please list the species you specifically intend to target.
NA

For a list of terrestrial species protected under the Endangered Species Act visit:
<http://www.fws.gov/endangered/>

For a list of marine species protected under the Endangered Species Act visit:
<http://www.nmfs.noaa.gov/pr/species/esa/>

For information about species protected under the Marine Mammal Protection Act visit:

<http://www.nmfs.noaa.gov/pr/laws/mmpa/>

7. Answer the Findings below by providing information that you believe will assist the Co-Trustees in determining how your proposed activities are compatible with the conservation and management of the natural, historic, and cultural resources of the Monument:

The Findings are as follows:

a. How can the activity be conducted with adequate safeguards for the cultural, natural and historic resources and ecological integrity of the Monument?

The activity will be conducted with adequate safeguards for the resources and ecological integrity of the Monument. For top predators we use non-lethal catch and release, and telemetry techniques that have minimal impact on the resources and ecological integrity of the Monument. Some reef fishes will be lethally sampled, but only at very low numbers per site (no more than 10 individuals per species), and overall (60 fish total from 2 sites at FFS atoll). We will also share specimens with other researchers for genetic analysis and life history characterization so that lethally-sampled fishes are fully utilized. This project is a continuing effort to quantify top predator movements and feeding ecology throughout the NWHI for the purpose of informing management. Principal Investigator Carl Meyer has previously consulted with William Aila about the cultural implications of this research. Mr Aila is very familiar with our research, having both observed and assisted us during shark tagging activities conducted at French Frigate Shoals in June 2010. This provided a valuable opportunity for Carl Meyer to discuss at length with Mr Aila the challenges associated with balancing cultural concerns against the need for directed management of Monument resources, including the gathering of scientific knowledge. We welcome further discussion with cultural experts to ensure our continuing research is pono.

b. How will the activity be conducted in a manner compatible with the management direction of this proclamation, considering the extent to which the conduct of the activity may diminish or enhance Monument cultural, natural and historic resources, qualities, and ecological integrity, any indirect, secondary, or cumulative effects of the activity, and the duration of such effects?

The proposed activities will have minimal impact on the resources of the region. The top predator tracking & sampling research consists of non-lethal catch and release, telemetry monitoring, autonomous data-logging and tissue sampling. A limited amount of lethal sampling (60 reef fishes total, 10 per species per sample site) will be conducted at FFS atoll. This research is being conducted in concert with the priorities listed in Monument research plan for the Monument. The scientific knowledge provided by these activities will help managers to better understand the role of sharks and other top predators in Monument ecology.

c. Is there a practicable alternative to conducting the activity within the Monument? If not, explain why your activities must be conducted in the Monument.

There is no practicable alternative to conducting activities in the Monument. We are addressing questions that are directly relevant to management of Monument resources (we are quantifying movement patterns & feeding ecology of top predators throughout the Monument), hence the study must be carried out within the Monument.

d. How does the end value of the activity outweigh its adverse impacts on Monument cultural, natural and historic resources, qualities, and ecological integrity?

The management value of data produced by our research activities outweighs the minor, transient impacts on Monument resources. The methods and procedures that we are proposing will have minimal impacts on Monument resources, qualities, and ecological integrity. No predators will be removed from the Monument and we have empirical data showing that tagged predators resume normal patterns of behavior soon after release (e.g., Meyer et. al. 2007a,b, 2009, 2010). Up to 60 reef fishes will be removed from FFS atoll, but these will provide valuable data on a little-studied habitat (mesophotic reefs) that is an important component of the Monument ecosystem. Our receivers are stationed on uncolonized habitats, and removal will leave no evidence of their presence in shallow habitats (see Appendix 2), and leave only a small end weight in mesophotic habitats. The scientific knowledge provided by these activities will help managers to better understand the role of sharks and other top predators in the Monument ecosystem.

e. Explain how the duration of the activity is no longer than necessary to achieve its stated purpose.

The actual fieldwork component of this research involves the minimum time required to reach the desired sample size of sharks and fishes based on historical catch rates. The monitoring of long-term predator movements is done remotely using small receivers left in situ year-round. The multi-year overall time frame of our proposed activities is consistent with our objectives of quantifying long-term movement patterns of predators in Monument waters. Long-term studies are essential for identifying seasonal movements and determining how movement patterns vary over multi-year time-scales.

f. Provide information demonstrating that you are qualified to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

Key project members

Carl Meyer (University of Hawaii): Twenty-five years of experience in fish telemetry, and over a decade of experience studying predator movements in Papahānaumokuākea.

Yannis Papastamatiou (Florida International University): Seventeen years of experience in fish telemetry, and over a decade of experience studying predator movements in Papahānaumokuākea.

Brian Popp (University of Hawaii): 38 years of experience in stable isotope studies and for the last 10 years has been a world leader in the application of carbon and nitrogen isotopic compound-specific isotope results to marine ecology.

We recently published a study of predator-mediated trophic linkages between mesophotic and shallow coral habitats at PHR (Papastamatiou et al. 2015) that provides a valuable comparison and framework for work proposed at FFS. Meyer & Papastamatiou have collaborated on predator tracking studies at FFS using for over a decade and have intimate knowledge of the local environment at this atoll, and a demonstrated ability to perform successful acoustic monitoring studies at this location (Meyer et al. 2007a,b, Meyer et al. 2010). Popp and colleagues resulted published a study using results of amino acid compound specific isotope analyses of mesophotic and shallow reef fish in the MHI to evaluate the differences in trophic ecology and flow of carbon and nitrogen in these populations. These results placed important constraints on models used to predict trophic positions of ecosystem components that are widely used to manage shallow and mesophotic reef fish populations.

g. Provide information demonstrating that you have adequate financial resources available to conduct and complete the activity and mitigate any potential impacts resulting from its conduct.

Our research will be supported by resources from University of Hawaii, and Florida International University. We are also optimistic about receiving National Fish and Wildlife Foundation funding to support mesophotic studies. These resources will be adequate to conduct and complete the proposed activities and mitigate any potential impacts resulting from its conduct

h. Explain how your methods and procedures are appropriate to achieve the proposed activity's goals in relation to their impacts to Monument cultural, natural and historic resources, qualities, and ecological integrity.

The methods and procedures that we are proposing are ideal for achieving our goals with minimal impacts to Monument resources, qualities, and ecological integrity. The use of passive monitoring techniques (self-contained acoustic receivers) means that we need relatively little human access to the Monument in order to achieve continuous, year-round monitoring of predator movements. Our shallow site receivers are stationed on uncolonized habitats, and removal will leave no evidence of their presence (see Appendix 2). Mesophotic receivers leave a small end-weight behind on recovery. No top predators will be removed from the Monument as a result of our research, and we have empirical data showing that tagged predators resume normal patterns of behavior soon after release (e.g., Meyer et. al. 2007a,b, 2010). Our datalogging (accelerometer-camera) techniques will provide novel insight into predator behavior via brief (days),

temporary attachment of datalogging packages that release from predators automatically, float to the surface and are recovered via a homing beacon. A very limited amount of lethal sampling (60 reef fishes total, maximum 10 fish per species per sample site) will be conducted at FFS atoll.

i. Has your vessel been outfitted with a mobile transceiver unit approved by OLE and complies with the requirements of Presidential Proclamation 8031?

We will use a combination of NOAA and private charter vessels equipped with appropriate mobile transceiver units.

j. Demonstrate that there are no other factors that would make the issuance of a permit for the activity inappropriate.

We have met all requirements of previously issued permits for research work in PMNM. There are no other factors that would make the issuance of a permit for our proposed activities inappropriate.

8. Procedures/Methods:

Activities will be carried out from small boats launched from a mother ship. Servicing of receivers will be done by snorkelers and SCUBA divers, and from small boats via an acoustic release system. Our chosen long-term monitoring method (remote acoustic monitoring) is ideal for quantifying animal movements in remote, environmentally-sensitive locations because it has minimal environmental impact and requires only occasional, brief access by researchers to individual study sites, yet provides continuous monitoring of animal movements at those sites. Shorter term datalogging involves temporary attachment of small devices to study species. The devices release automatically at a pre-determined time and are found and recovered via a homing beacon. We have previously used this datalogging technique successfully in Monument waters.

(a) Recovery and redeployment of underwater receivers

Shallow (<30 m) deployments: We will continue to use a temporary receiver mooring system that has previously been empirically demonstrated to successfully withstand seasonal high surf. Moorings, installed by snorkelers or SCUBA divers will consist of sand screws in areas of soft sediment, and chain around uncolonized substrate in hard bottom areas (live substrates will be avoided). We will completely remove these moorings when acoustic monitoring is completed (receivers will be in place for at least 2 years). The receivers will be anchored to the moorings and suspended 1-4 m above the ocean floor. The receivers will identify and record the presence of any acoustic transmitters within range (up to 500 m). The transmitter number, time of arrival and departure and the date will be recorded and stored until the data are downloaded from

the receivers to a computer. The receivers have a battery life of approximately 15 months and will be serviced at 12 month intervals.

Deep (mesophotic >50m) deployments: We will recover and redeploy underwater receivers at existing mesophotic sites at Pearl and Hermes Reef and French Frigate Shoals atoll. Receivers will be attached to weighted (with concrete block) moorings, and dropped to the sea floor so that they land on flat, uncolonized habitat (determined via echosounding). The moorings will incorporate an acoustic release to allow for surface recovery. Use of an acoustic release means the end weights and lower 30cm of the mooring (chain, polypro and twine) are sacrificial and will be left in situ when the receivers are recovered. As with shallow units, the mesophotic zone receivers will be suspended 4 m above the ocean floor and will be serviced at 12 month intervals.

(b) Data retrieval, reduction and analysis.

We will download receivers currently deployed in Monument waters (Appendix 1). Data downloading consists of interfacing the receiver to a computer via a wireless 'bluetooth' connection, and can be accomplished in the field. Preliminary data reduction and analyses will commence after downloading.

(c) Deployment of acoustic transmitters

We will implant acoustic transmitters into up to 60 Galapagos sharks and ulua captured at FFS atoll. Our predator handling & tagging activities will be carried out in accordance with the animal use protocols of the University of Hawaii. Ulua will be captured by trolling (using an artificial lure) and handlining (using a single baited hook) from a small skiff. Sharks will be captured by handlining (using a single baited hook) from a small skiff and using a bottom-set, 10 hook shark line. Captured sharks and ulua will be brought alongside the skiff, tail-rope and inverted to initiate tonic immobility for transmitter implantation. We will implant coded acoustic transmitters (V16 & V16P, 16 mm diameter, 90 mm long, Vemco, Halifax, Nova Scotia) into the body cavities of each predator through a small incision in the abdominal wall (Holland et al., 1999; Meyer & Honebrink 2005, Meyer et al. 2007a,b, 2010). The incision will then be sutured closed, a small tissue sample will be taken from the dorsal musculature (see also below), the hook removed and the predator released. This entire handling process can be completed in less than 10 minutes. Every fish and shark captured and equipped with an acoustic tag will also receive an external dart tag.

Previous reviews of the above capture procedures have prompted a series of questions about potential impacts on other species. To provide additional information we have included these questions and our responses;

1. What kind of by-catch is likely to occur?

Trolling by-catch includes reef-associated piscivores attracted to artificial lures, primarily uku (*Aprion virescens*). Baited handlines and sharklines very rarely catch anything other than target species. Any non-target species are immediately released.

2. How can by-catch be minimized or mitigated?

Non-target fishes captured by trolling are immediately released. If by-catch becomes more than occasional then trolling is ceased in that area.

3. Are lines an entanglement hazard for seals? What mitigation measures are taken?

No. Handlines (baited and trolled) are manned constantly. We have not been approached by seals while using these methods. We have never had any seal interactions with bottom-set shark lines. These are heavy gauge lines with heavy end-weights and large surface floats, resulting in a 'taut' deployment, greatly reducing entanglement risks. As an added precaution we constantly monitor any such lines set within 1 km of seal haul-out sites.

4. Has there been any seabird interaction with the fishing gear?

Seabirds are sporadically attracted by trolling activities. Fishing is ceased and lines retrieved whenever birds show interest in the fishing gear. By taking these precautions we have avoided any physical interactions between birds and trolling gear.

(d) Deployment and recovery of accelerometer-digital camera dataloggers

Shark and ulua capture methods for accelerometer deployment methods are identical to those described in item (c) above. Each datalogger package will consist of a tri-axial accelerometer (W1000L-PD3GT, 22 mm in diameter, 123 mm in length, 90 g in air; Little Leonardo Co., Tokyo, Japan) and a digital camera (DSL380-VDT, 22 mm in diameter, 132 mm in length, 83 g in air; Little Leonardo Co., Tokyo, Japan), attached to a float equipped with a VHF transmitter and timed release mechanism (see picture - Appendix 3).

Accelerometers record swimming speed, depth, temperature (at 1 s intervals), and tri-axial acceleration (at 1/32 s intervals, 32 Hz). Digital video cameras capture 8h hours of duty-cycled footage (i.e. the 8h can be spread across several days of deployment), and record depth and temperature at 1 sec intervals. Total device weights in air are 311g, and their buoyancies are offset by 76 g in sea water. The accelerometer package will be attached to the left or right pectoral fin of each shark by cable ties secured through two small holes drilled through the fin (see picture - Appendix 3). The devices will be attached to the second dorsal fin of each ulua using cable ties secured through small holes through the superficial dorsal musculature below the dorsal fins. After 24-48 h, a pre-programmed release timer will release the cable tie and allow the instruments to detach and float to the surface, where they will be located using the VHF transmitter and retrieved. Nothing is left attached to the animal.

(e) Collection of tissue biopsies from predators

Predator capture methods for tissue biopsy collections are identical to those described in item (c) above. We will collect small muscle biopsies from all predators captured. This involves making a small incision in the skin and using a biopsy tip to remove approximately 0.5 cc of muscle. These samples will be collected while predators are restrained for tagging. Tissue samples will be transferred to small plastic vials, frozen and transported back to Honolulu for laboratory analyses (stable isotope content).

(f) Collection of tissue biopsies from prey species

To obtain reference 'signatures' of chemical composition of potential prey (smaller reef fishes), we will lethally collect a total of 60 reef fishes from shallow and mesophotic sites at FFS atoll. We will sample up to 10 individuals per target species at each site. Muscle tissue will be obtained from individuals of each species for stable isotope analysis. Note that to minimize temporal variation in isotope signatures, tissue samples from predators/reef fish/algae need to be collected at the same time (i.e. we cannot use tissues from frozen specimens collected in previous years).

(g) Chemical analyses of tissue samples

Stable isotopes: The composition of heavy isotopes in an animal's tissues reflects that of its food, and the isotopic signature of the primary producers in the ecosystem. The $^{15}\text{N} : ^{14}\text{N}$ ratio is an indicator of a predator's trophic position in the food web, while the $^{13}\text{C} : ^{12}\text{C}$ ratio highlights the source of carbon for the primary producers at the base of the food chain from which the predator is feeding (e.g. coastal or pelagic, Post 2002). Samples will be frozen until they are processed at the stable isotope laboratory at the University of Hawaii at Manoa. Samples are dried in a 60 °C drying oven for at least 48 h or until the sample are completely dried out, and then ground into a fine powder and weighed out into micro sampling dishes. We will use a carbon-nitrogen analyzer (Finnigan ConFlo II/Delta-Plus, Bremen, Germany) to determine the relative concentration of heavy ^{15}N and ^{13}C in each sample. Values are presented as ‰, relative to standards of V-PDB and atmospheric N_2 for ^{13}C and ^{15}N respectively.

Additional References

Holland KN, Wetherbee BM, Lowe CG and CG Meyer (1999) Movements of tiger sharks (*Galeocerdo cuvier*) in coastal Hawaiian waters. Marine Biology 134: 665-673.

Meyer CG and R Honebrink (2005) Retention of surgically implanted transmitters by bluefin trevally (*Caranx melampygus*). Implications for long-term movement studies. Transactions of the American Fisheries Society. 134:602-606.

Post D.M., 2002. Using stable isotopes to estimate trophic position: models, methods, and assumptions. Ecology 83(3): 703-718

NOTE: If land or marine archeological activities are involved, contact the Monument Permit Coordinator at the address on the general application form before proceeding.

9a. Collection of specimens - collecting activities (would apply to any activity): organisms or objects (List of species, if applicable, attach additional sheets if necessary):

Common name:
Please refer to Appendix 4

Scientific name:
Please refer to Appendix 4
& size of specimens:
Please refer to Appendix 4

Collection location:
Shallow and mesophotic reefs around FFS

☒ Whole Organism ☒ Partial Organism

9b. What will be done with the specimens after the project has ended?

Fish tissue samples will be utilized for stable isotope analysis. Remains of reef fishes will be passed on to researchers studying genetic conductivity and life history characteristics in the Monument.

9c. Will the organisms be kept alive after collection? ☐ Yes ☒ No

• General site/location for collections:

Shallow and mesophotic reefs at FFS

• Is it an open or closed system? ☐ Open ☐ Closed
N/A

• Is there an outfall? ☐ Yes ☐ No
N/A

• Will these organisms be housed with other organisms? If so, what are the other organisms?
N/A

• Will organisms be released?

Predators = yes - see procedures section above.
Prey items = no. Reef fishes will be sacrificed.

10. If applicable, how will the collected samples or specimens be transported out of the Monument?

Muscle tissue and whole reef fishes will be stored frozen for transport out of the Monument.

11. Describe collaborative activities to share samples, reduce duplicative sampling, or duplicative research:

We will share all reef fish specimens with researchers studying genetic conductivity and life history characteristics of reef fishes. Brian Popp (UH-SOEST) will be using stable isotopes to determine if there is a difference in signal between shallow and deep counterparts, which will be required if we are to determine if predators are foraging on deep reefs.

12a. List all specialized gear and materials to be used in this activity:

Please refer to Appendices 2 and 3

12b. List all Hazardous Materials you propose to take to and use within the Monument:

N/A

13. Describe any fixed installations and instrumentation proposed to be set in the Monument:

Please refer to Appendix 2

14. Provide a time line for sample analysis, data analysis, write-up and publication of information:

Predator tagging, camera and receiver deployments will be completed during the 2018 research cruise. Camera footage will also be recovered during the 2018 cruise. Underwater receivers will monitor and record predator movements for ~12 months before being recovered and downloaded during a 2019 research cruise (we have successfully maintained continuous acoustic monitoring coverage at FFS since 2005). Analyses of predator movement data will be completed by the end of 2019. Tissue samples will be collected at FFS during the summer 2018 research cruise and stable isotope analyses will be completed by spring 2019. We are publishing data from our Monument studies on an ongoing basis and we anticipate publishing food-web and nutrient transport results for FFS in late 2019/early 2020.

15. List all Applicants' publications directly related to the proposed project:

Dale JJ, Stankus AM, Burns MS, Meyer CG. 2011. The Shark Assemblage at French Frigate Shoals Atoll, Hawai'i: Species Composition, Abundance and Habitat Use. PLoS ONE 6(2): e16962. doi:10.1371/journal.pone.0016962

Dale JJ, Meyer CG, Clark CE. 2011. The ecology of coral reef top predators in the Papahānaumokuākea Marine National Monument. Journal of Marine Biology. 2011:1-14. doi:10.1155/2011/725602.

Iosilevskii G, Papastamatiou YP, Meyer CG, Holland KN. 2012. Energetics of the yo-yo dives of predatory sharks. Journal of Theoretical Biology. 294:172–181.

Meyer CG, Papastamatiou YP, Holland KN. 2007. Seasonal, diel and tidal movements of green jobfish (*Aprion virescens*, Lutjanidae) at remote Hawaiian atolls: Implications for Marine Protected Area design. Marine Biology. 151: 2133-2143.

Meyer CG, Holland KN, Papastamatiou YP. 2007. Seasonal and diel movements of giant trevally (*Caranx ignobilis*) at remote Hawaiian atolls: implications for the design of Marine Protected Areas. Marine Ecology Progress Series. 333: 13-25.

Meyer C.G., T.B. Clark, Y.P. Papastamatiou, N.M. Whitney, & K.N. Holland. (2009). Long-term movements of tiger sharks (*Galeocerdo cuvier*) in Hawaii. Marine Ecology Progress Series. 381: 223-235.

Meyer CG, Papastamatiou YP, Holland KN (2010). A multiple instrument approach to quantifying the movement patterns and habitat use of tiger and Galapagos sharks at French Frigate Shoals, Hawaii. Marine Biology 157: 1857-1868

Meyer CG, Holland KN. 2012. Autonomous measurement of ingestion and digestion processes in free swimming sharks. Journal of Experimental Biology. 215, 3681-3684. doi:10.1242/jeb.075432.

Meyer C, O'Malley J, Papastamatiou Y, Dale J, Hutchinson M, Anderson J, Royer M, Holland K. 2014. Growth and maximum size of tiger sharks (*Galeocerdo cuvier*) in Hawaii. PLoS One 9:e84799

Meyer CG. 2017. Electronic tags reveal the hidden lives of fishes. Bulletin of Marine Science. 93: 301-318. DOI: 10.5343/bms.2016.1030.

Nakamura I, Watanabe YY, Papastamatiou YP, Sato K, Meyer CG. 2011. Yo-yo vertical movements suggest a foraging strategy for tiger sharks *Galeocerdo cuvier*. Marine Ecology Progress Series. 424: 237–246. doi: 10.3354/meps08980.

Papastamatiou YP, Friedlander AM, Caselle JE, Lowe CG. 2010. Long term movement patterns and trophic ecology of blacktip reef sharks (*Carcharhinus melanopterus*) at Palmyra Atoll. *Journal of Experimental Marine Biology and Ecology* 386: 94-102

Papastamatiou YP, Cartamil DP, Lowe CG, Meyer CG, Wetherbee, BM, Holland KN. 2011. Scales of orientation, directed walks, and movement path structure in sharks. *Journal of Animal Ecology*. 80:864-874.

Papastamatiou YP, Meyer C., Carlvaho F., Dale J., Hutchinson M., Holland K. 2013. Telemetry and random walk models reveal complex patterns of partial migration in a marine predator. *Ecology*. 94: 2595-2606

Papastamatiou YP, Meyer CG, Kosaki RK, Natalie J. Wallsgrove NJ, Popp BN. 2015. Movements and foraging of predators associated with mesophotic reefs and their potential for linking ecological habitats. *Marine Ecology Progress Series*: 521:155-170. doi:10.3354/meps11110.

With knowledge of the penalties for false or incomplete statements, as provided by 18 U.S.C. 1001, and for perjury, as provided by 18 U.S.C. 1621, I hereby certify to the best of my abilities under penalty of perjury of that the information I have provided on this application form is true and correct. I agree that the Co-Trustees may post this application in its entirety on the Internet. I understand that the Co-Trustees will consider deleting all information that I have identified as "confidential" prior to posting the application.

Signature  Date 1/30/18

SEND ONE SIGNED APPLICATION VIA MAIL TO THE MONUMENT OFFICE BELOW:

NOAA/Inouye Regional Center
NOS/ONMS/PMNM/Attn: Permit Coordinator
1845 Wasp Blvd, Building 176
Honolulu, HI 96818
FAX: (808) 455-3093

DID YOU INCLUDE THESE?

- ☒ Applicant CV/Resume/Biography
- ☐ Intended field Principal Investigator CV/Resume/Biography
- ☒ Electronic and Hard Copy of Application with Signature
- ☐ Statement of information you wish to be kept confidential
- ☐ Material Safety Data Sheets for Hazardous Materials

Papahānaumokuākea Marine National Monument Compliance Information Sheet

1. Updated list of personnel to be covered by permit. List all personnel names and their roles here (e.g. John Doe, Diver; Jane Doe, Field Technician, Jerry Doe, Medical Assistant): Carl Meyer (PI), Kosta Stamoulis (Field Tech), Kaylee Scidmore (Field Tech), Field Tech TBD

2. Specific Site Location(s): (Attach copies of specific collection locations):

Atoll	Location	Latitude	Longitude	Depth (ft)
FFS	FFS SE Shallow	23.62558	-166.13953	44.7
FFS	Rapture Reef	23.63509	-166.18570	85
FFS	FFS SW Shallow	23.63764	-166.20760	54
FFS	Gins Deep	23.72615	-166.16967	40
FFS	SE of La Perouse	23.74926	-166.21773	70
FFS	East Island	23.78686	-166.20709	10
FFS	NE of La Perouse	23.80545	-166.26106	72
FFS	Round & Mullet	23.82747	-166.22857	10
FFS	Tern Island	23.86664	-166.28820	10
FFS	Trig Island	23.86945	-166.24158	15
PHR	Deep ledge 1	27.76206	-175.98315	225
PHR	Meso Mid Ledge	27.76516	-175.89575	282
PHR	Meso Main Channel	27.78393	-175.85762	298
PHR	SW Corner	27.75290	-175.94805	50
PHR	SE Channel	27.78702	-175.83623	30
PHR	Main Channel	27.79092	-175.86300	35
PHR	W Spur and Groove	27.80215	-176.01095	100
PHR	NE Side	27.90115	-175.72205	65
PHR	NW Side	27.91095	-175.90890	85
MID	Frigate Point	28.19113	-177.39454	30
MID	Fish Hole	28.19742	-177.36272	40

3. Other permits (list and attach documentation of all other related Federal or State permits): None

3a. For each of the permits listed, identify any permit violations or any permit that was suspended, amended, modified or revoked for cause. Explain the circumstances

surrounding the violation or permit suspension, amendment, modification or revocation. N/A

4. Funding sources (Attach copies of your budget, specific to proposed activities under this permit and include funding sources. See instructions for more information): This research is being supported by an award from the National Fish and Wildlife Foundation.

5. Time frame:

Activity start: June 31 2018

Activity completion: September 2019

Dates actively inside the Monument:

From: 6/30/2018

To: 7/10/2018

Describe any limiting factors in declaring specific dates of the proposed activity at the time of application: None

Personnel schedule in the Monument: June 30th enter Monument, July 1 Arrive French Frigate Shoals, July 8 Depart French Frigate Shoals, July 10 exit Monument.

6. Indicate (with attached documentation) what insurance policies, bonding coverage, and/or financial resources are in place to pay for or reimburse the Monument trustees for the necessary search and rescue, evacuation, and/or removal of any or all persons covered by the permit from the Monument:

7. Check the appropriate box to indicate how personnel will enter the Monument:

- ☒ Vessel
☐ Aircraft

Provide Vessel and Aircraft information: MV Searcher

8. The certifications/inspections (below) must be completed prior to departure for vessels (and associated tenders) entering the Monument. Fill in scheduled date (attach documentation):

- ☒ Rodent free, Date: TBD
- ☒ Tender vessel, Date: TBD
- ☐ Ballast water, Date: N/A
- ☐ Gear/equipment, Date: N/A
- ☒ Hull inspection, Date: TBD

9. Vessel information (NOTE: if you are traveling aboard a National Oceanic and Atmospheric Administration vessel, skip this question):

Vessel name: Searcher

Vessel owner: The Medical Foundation

Captain's name: Jon Littenberg

IMO#: 8981884

Vessel ID#: 1103056

Flag: USA

Vessel type: Steel Trawler

Call sign: WDA6100

Embarkation port: Honolulu

Last port vessel will have been at prior to this embarkation: Honolulu

Length: 30m

Gross tonnage: 105

Total ballast water capacity volume (m3): N/A

Total number of ballast water tanks on ship: 0

Total fuel capacity: 9600 US gallons

Total number of fuel tanks on ship: 6

Marine Sanitation Device: Headhunter Marine

Type: II

Explain in detail how you will comply with the regulations regarding discharge in the Monument. Describe in detail. If applicable, attach schematics of the vessel's discharge and treatment systems: All black and grey waters shall be stored in holding tanks until our departure from Monument waters. All rubbish and recycling shall be securely stored aboard for proper disposal upon our return to Honolulu.

Other fuel/hazardous materials to be carried on board and amounts: Small amounts of gasoline for the outboards on the skiffs, approximately 30 gal

Provide proof of a National Oceanic and Atmospheric Administration (NOAA) Office of Law Enforcement-approved Vessel Monitoring System (VMS). Provide the name and contact information of the contractor responsible for installing the VMS system. Also describe VMS unit name and type: Thrane and Thrane Sailor

VMS Email: 436998398@c.xantic.net

Inmarsat ID#: 4tto92e62b15

* Individuals **MUST ENSURE** that a type-approved VMS unit is installed and that its automatic position reports are being properly received by the NOAA OLE system prior to the issuance of a permit. To make sure your VMS is properly configured for the NOAA OLE system, please contact NOAA OLE at (808) 725-6110 or (808) 725-6100.

* **PERMITS WILL NOT BE ISSUED TO INDIVIDUALS ENTERING THE MONUMENT VIA VESSEL UNTIL NOAA OLE HAS CONTACTED THE MONUMENT PERMIT COORDINATOR WITH A 'POSITIVE CHECK' READING.**

10. Tender information:

On what workboats (tenders) will personnel, gear and materials be transported within the Monument? List the number of tenders/skiffs aboard and specific types of motors: Two of the following: Zodaic mark v (90 horsepower evinrude), Zodiac Mark V (60 hp evinrude), 20 ft Carolina Skiff 90hp honda

Additional Information for Land Based Operations

11. Proposed movement of personnel, gear, materials, and, if applicable, samples:

12. Room and board requirements on island:

13. Work space needs:

DID YOU INCLUDE THESE?

- ☐ Map(s) or GPS point(s) of Project Location(s), if applicable
- ☐ Funding Proposal(s)
- ☐ Funding and Award Documentation, if already received
- ☐ Documentation of Insurance, if already received
- ☐ Documentation of Inspections
- ☐ Documentation of all required Federal and State Permits or applications for permits

DAVID Y. IGE
GOVERNOR OF HAWAII



**STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES**

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

June 22, 2018

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT MASUDA
FIRST DEPUTY

JEFFREY PEARSON P.E.
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

TO: Division of Aquatic Resources File

THROUGH: Suzanne D. Case, Chairperson

FROM: Maria Carnevale
Papahānaumokuākea Marine National Monument

**DECLARATION OF EXEMPTION FROM THE PREPARATION OF AN ENVIRONMENTAL ASSESSMENT UNDER
THE AUTHORITY OF CHAPTER 343, HRS AND CHAPTER 11-200 HAR, FOR PAPAHA NAUMOKU AKEA
MARINE NATIONAL MONUMENT RESEARCH PERMIT TO DR. CARL MEYER, HAWAII INSTITUTE OF
MARINE BIOLOGY, UNIVERSITY OF HAWAII, FOR ACCESS TO STATE WATERS
TO CONDUCT RESEARCH ACTIVITIES TO QUANTIFY THE MOVEMENTS AND ECOLOGY OF TOP
PREDATORS UNDER PERMIT PMNM-2018-015**

The following permitted activities are found to be exempted from preparation of an environmental assessment under the authority of Chapter 343, HRS and Chapter 11-200, HAR:

Project Title:

Papahānaumokuākea Marine National Monument Research Permit to Dr. Carl Meyer, Hawaii Institute of Marine Biology, University of Hawaii, for Access to State Waters to Conduct Research Activities to Quantify the Movements and Ecology of Top Predators.

Permit Number: PMNM-2018-015

Project Description:

The applicant proposes to conduct renewal activities to study the foraging ecology, movement, and distribution patterns of top marine predators (shark and large fish species).

No land access is proposed. The applicant and up to six individuals would conduct maintenance, download and redeploy acoustic receivers at French Frigate Shoals, Pearl and Hermes Atoll, and Midway Atoll. Additional activities include lethally sampling up to 60 of the most common reef fishes from shallow and mesophotic reefs at FFS; equipping up to 60 additional ulua and Galapagos sharks (30 of each species at FFS) with pressure-sensor acoustic transmitters (detectable by the aforementioned acoustic receivers); equipping 5 ulua, 5 Galapagos sharks, and 5 tiger sharks with accelerometers and digital camera data loggers; and collecting muscle tissue samples from ulua and sharks. Sharks and ulua would be caught by fishing with artificial lures, mackerel (frozen), tuna,

and fish caught under a separate Native Hawaiian Practices permit (pending issuance of permit no. PMNM-2018-030). Lastly, the proposed activities would be supported by the MV *Searcher* (includes up to six crew members) which includes the following activities: anchoring on sandy substrate and discharging gray water and biodegradable waste from galley operations.

Up to eight (8) individuals (including the applicant) would conduct proposed activities and access the Monument via a separately permitted vessel. For 2018, the applicant intends to conduct research activities during a research cruise aboard M/V *Searcher*. Proposed activity locations include marine areas within all Special Preservation Areas (SPAs) and the Midway Atoll Special Management Area.

To safeguard Monument resources the applicant would abide by the following PMNM Best Management Practices (BMPs) while conducting the aforementioned activities within the PMNM: Best Management Practices for Boat Operations and Diving Activities (BMP #004); Marine Wildlife Viewing Guidelines (BMP #010); and Disease and Introduced Species Prevention Protocol for Permitted Activities in the Marine Environment (BMP #011).

The activity would provide empirical data on top predator's spawning habits, population sizes and movement patterns in the Monument. The applicant's proposed activities directly support the Monument Management Plan (MMP) Marine Conservation Science (MCS) Action Plan Strategy MCS-1: Continue and enhance research, characterization and monitoring of marine ecosystems (PMNM MMP Vol. I, p. 122, 2008).

Consulted Parties:

The permit application was sent out for review and comment to the following scientific and cultural entities: Hawai'i Division of Aquatic Resources, Hawai'i Division of Forestry and Wildlife, Papahānaumokuākea Marine National Monument (NOAA/NOS), NOAA Pacific Islands Regional Office (NOAA-PIRO), United States Fish and Wildlife Service Hawaiian and Pacific Islands National Wildlife Refuge Complex Office, and the Office of Hawaiian Affairs (OHA). In addition, the permit application has been posted on the Monument Web site since February 16, 2018, giving the public an opportunity to comment. The application was posted within 40 days of its receipt, in accordance with the Monument's Public Notification Policy.

Exemption Determination:

After reviewing HAR § 11-200-8, including the criteria used to determine significance under HAR § 11-200-12, DLNR has concluded that the activities under this permit would have minimal or no significant effect on the environment and that issuance of the permit is categorically exempt from the requirement to prepare an environmental assessment based on the following analysis:

1. All activities associated with this permit; including the tagging of the subject sharks and fishes, collection of tissue biopsies, and recovery and redeployment of underwater acoustic receivers; have been evaluated as a single action. As a preliminary matter, multiple or phased actions, such as when a group of actions are part of a larger undertaking, or when an individual project is precedent to or represents a commitment to a larger project, must be grouped together and evaluated as a single action. HAR § 11-200-7. This permit may involve an activity that is precedent to a later

planned activity, i.e. the future recovery of underwater acoustic receivers and containing predator movement data; the categorical exemption determination here will treat all planned activities as a single action.

2. The Exemption Class for Scientific Research with no Serious or Major Environmental Disturbance Appears to Apply. Chapter 343, HRS, and § 11-200-8, HAR, provide for a list of classes of actions exempt from environmental assessment requirements. HAR §11-200-8.A.5. exempts the class of actions which involve “basic data collection, research, experimental management, and resource evaluation activities which do not result in a serious or major disturbance to an environmental resource.” The proposed predator feeding and tagging study activities here appear to fall squarely under the exemption class #5, exempt item #3 as described under the Division of Forestry and Wildlife exemption list published on June 12, 2008. This exemption class has been interpreted to include “affixing transmitters, markers to wild animals to record movement longevity”, such as those being proposed. As discussed below, no significant disturbance to any environmental resource is anticipated in the tagging of top predators, recovery of instrumental deployment, to monitor predator movements, or collection of potential prey items including reef fish. Thus, so long as the below considerations are met, an exemption class should include the action now contemplated.

To safeguard Monument resources the Applicant would abide by the following PMNM Best Management Practices (BMPs) while conducting the aforementioned activities within the PMNM: Best Management Practices for Boat Operations and Diving Activities (BMP #004); General Storage and Transport Protocols for Collected Samples (BMP #006); Seabird Protocols Necessary for Conducting Trolling Research and Monitoring (BMP #008); Marine Wildlife Viewing Guidelines (BMP #010); and Disease and Introduced Species Prevention Protocol for Permitted Activities in the Marine Environment (BMP #011). With respect to predator capture using trolling and handlining, if any non-target species are capture, they would be released. If bycatch becomes more than occasional, then trolling would cease in that area. To minimize fishing line entanglement with seals or seabirds, handlines would be constantly manned. Fishing would cease and lines retrieved whenever birds show an interest in fishing gear.

3. Cumulative Impacts of Actions in the Same Place and Impacts with Respect to the Potentially Particularly Sensitive Environment Will Not be Significant. Even where a categorical exemption appears to include a proposed action, the action cannot be declared exempt if “the cumulative impact of planned successive actions in the same place, over time, is significant, or when an action that is normally insignificant in its impact on the environment may be significant in a particularly sensitive environment.” HAR § 11-200-8.B. To gauge whether a significant impact or effect is probable, an exempting agency must consider every phase of a proposed action, any expected primary and secondary consequences, the long-term and short-term effects of the action, the overall and cumulative effect of the action, and the sum effects of an action on the quality of the environment. HAR § 11-200-12. Examples of actions which commonly have a significant effect on the environment are listed under HAR § 11-200-12.

Proposed activities would be a continuation of activities permitted in the Monument from 2008 to 2017. Similar predator tagging and feeding activities have also been permitted and performed within the NWHI. Past permitted projects including similar collections and techniques have shown no adverse impacts. With that mind, significant cumulative impacts are not anticipated as a result of this activity, and numerous safeguards further ensure that the potential sensitive environment of the project area will not be significantly affected. All activities will be conducted in a manner compatible with the management direction of the Monument Proclamation in that the activities do not diminish Monument resources, qualities, and ecological integrity, or have any indirect, secondary, cultural, or cumulative effects. The joint permit review process did not reveal any anticipated indirect or cumulative impacts that would occur as a result of these activities.

These activities would be conducted from the M/V SEARCHER (Proposed under this application). Interactions with sharks at FFS are also anticipated with monk seal recovery activities conducted from the NOAA monk seal field camp. There are no other known proposed projects that would be undertaken with respect to sharks at FFS during this time.

The Applicant has been conducting top predator research activities for many years with no cumulative impacts noted. Though the potential permits may occur in the same area, each project differs logistically and targets interaction with different resources. Therefore, since no significant cumulative impacts or significant impacts with respect to any particularly sensitive aspect of the project area are anticipated, the categorical exemptions identified above should remain applicable.

4. Overall Impacts will Probably be Minimal and Insignificant Any foreseeable impacts from the proposed activity will probably be minimal, and further mitigated by general and specific conditions attached to the permit. Specifically, all conservation and management activities covered by this permit will be carried out with strict safeguards for the natural, historic, and cultural resources of the Monument as required by Presidential Proclamation 8031, other applicable law and agency policies and standard operating procedures.

Conclusion. Upon consideration of the permit to be approved by the Board of Land and Natural Resources, the potential effects of the above listed project as provided by Chapter 343, HRS and Chapter 11-200 HAR, have been determined to be of probable minimal or no significant effect on the environment and exempt from the preparation of an environmental assessment.